CHEMISTRY 301

ORGANIC CHEMISTRY I

Course Description: The topics in this first semester of Introductory Organic Chemistry are designed to gradually introduce the student to organic concepts while stressing their relationship to ideas addressed in General Chemistry. Lewis concepts of bonding and formulas, structural theory, isomerism, reaction energetics, orbital interactions, structure-property relationships, functional groups and families, acid-base chemistry, types of organic reagents and reactions, the hydrocarbons, stereochemistry, and S_N and E reactions are discussed. Significant accent is placed on discovering the interplay of electronic, steric and orbital factors in determining the fates of organic reactions as well as curved arrow convention and reaction energetics (including ΔH calculations and the relationship between kinetics and mechanism).

Prerequisite: CHEM 102.

Textbook: "Organic Chemistry," 6th Ed., TWG Solomons et al

Optional material: The textbook by Weeks on "Pushing electrons" is highly recommended. A molecular models kit (available in the bookstore) is also a very good idea to buy either individually or as part of a group. There is an abundance of my past exams/keys as well as worksheets on Blackboard. Use them as you study and prepare for exams. Although the same questions most likely will not appear on your exams, the reserve material gives a good indication of the types of questions that will feature on exams and, more importantly, of the depth of the responses I require

Course Objectives/Student Learning Outcomes: At the completion of this course students should be able to:

- predict and account for the physicochemical properties of organic compounds based upon their structures. *(GEC 1, 3, 4)*
- account for the behavior of organic compounds and the fates of organic reactions in terms of electronic, steric and orbital interactions. *(GEC 1, 3, 4)*
- describe preparative routes to the non-aromatic hydrocarbons, haloalkanes and alcohols/ethers. *(GEC 1, 3, 4)*
- discuss reaction pathways of the classes of organic compounds above *(1, 3, 4)*
- draw reasonable curved arrow mechanisms for reactions *(GEC 1, 3, 4)*
- profile and detail the S_N and E reactions *(GEC 1, 3, 4)*

Assessment:
Assessment of progress will be determined by classroom tests over the appropriate materials and a comprehensive final. The classroom tests and final may include short essays, short objective answers, calculations (with justifications), multiple choice or some combination of these.

Course Requirements and Evaluation: Students will be required to read and comprehend material covered in class as well as any assigned readings. To get the most out of lectures, students should read the material ***prior*** to the lecture. There will be 5 hourly tests plus the final (Your lowest hourly test grade will be dropped from your average). Each test that counts to your grade (and the final will be worth 20%). **Exams will be held on Fridays at 1:00-2:30 p.m. on the following dates: Sep 4th, 25th; Oct 16th; Nov 6th,27th.**

The grading scale is a modified ten point grading scale. Grades will not be curved.

A = 85-100; B = 75-84; C = 65-74; D = 55-64; F = 0-54

Students are strongly encouraged to attend all class meetings. Acceptable excused absences for tests include **only** illness (with a doctor's excuse), university functions, or a death in the immediate family. If you have other problems please contact the instructor prior to the test if possible.

Methods of Instruction: Instruction will consist of classroom (and possibly Blackboard) lectures and discussions, assigned readings, homework and other written assignments.

Course and University Policies:

Americans with Disabilities Act

It is each student's responsibility to register with the Office of Services for Students with Disabilities when requesting an accommodation. Any student with a disability is encouraged to contact the Office of Services for Students with Disabilities, Drew Hall, Room 200, (337) 475-5916 Voice, (337) 475-5878 FAX, (337) 562-4227 TDD/TTY, Hearing Impaired. 475-5722.

A student with a disability is responsible for locating the designated emergency exits, the areas of refuge in a classroom building, and is encouraged to develop and discuss the evacuation plan with the faculty member.

Fire Drill Policy

In compliance with federal regulation 29CFR1910.3, the National Fire Protection Association Standard NFPA 101, Life Safety Code, Section 4.7, and the State of Louisiana Office of Risk Management, McNeese State University will periodically conduct fire drills. In the event of a fire drill or a related building emergency, all persons in a classroom are required to exit the building using posted escape routes or the Area of Refuge for individuals with disabilities. All persons in class are required to follow the faculty member outside of the building to safety and are required to check in with the faculty member to ensure that everyone has safely exited the building. It is everyone's responsibility to ensure that emergency responders such as University Police or Building Coordinators are made aware of missing or injured persons and individuals with disabilities who evacuated to the Area of Refuge. No one may re-enter the building until an official all-clear is given by emergency responders.

Diversity Awareness Policy

McNeese's policy on Diversity Awareness can be found at http://www.mcneese.edu/policy/docs/NonDiscrimination%20Policy%20Revised%20%209-16-08.pdf

Academic Integrity Policy McNeese's policy on honesty is available at www.mcneese.edu/integrity

Attendance Policy:

Students are strongly urged **to regularly attend class and review sessions. Attendance will be taken at all lectures**

Course content: A module-based breakdown of the syllabus follows. Emboldened topics are heavily stressed.

Module 1

What is Organic Chemistry? Properties of Carbon. "Vitalism".

Empirical and Molecular formulas

The Structural Theory. Valence, Constitutional Isomerism, Indices of Hydrogen Deficiency.

Ionic and **Covalent bonding, factors affecting bond strength ($F \alpha q_1.q_2/r^2$)**

Lewis Structures and Resonance

Bond Energies, Morse Curves and Reaction Profile Diagrams

Orbital interactions: an MO picture of H_2 and related species (H_2^+, H_2^-, He_2, etc.), hybridization in Carbon

Bond and Molecular Polarity

Representation of structural formulas; Oxidation levels

Module 2

The hydrocarbons. **A survey of their C/C and C/H bonds, consequences in terms of bond strength, length, isomerism, acidity. MO picture of the C/C π bond.** Cis/trans isomerism.

Functional groups and families of organic compounds. Subclassifications (1^o, 2^o, 3^o, etc, carbons, hydrogens, haloalkanes, amines)

Organic nomenclature

Structure/Property relationships. Intermolecular forces

Module 3

Types of organic reagents and reactions

Homolysis/heterolysis, the common organic intermediates

Def'n of "mechanism". Mechanism from kinetics and stoichiometry. Transition states, intermediates, reaction profile diagrams.

Acid/base chemistry

Module 4

The curved arrow convention.

Module 5

Properties of alkanes/cycloalkanes.

Conformations and conformational analyses. Newman projection formulas

Determinations of relative stabilities in alkenes and cycloalkanes. Ring strain.

Conformations of Cyclohexanes

Preparations of alkanes [hydrogenation and from haloalkanes (4 methods)]

Free Radical Halogenation

Module 6

Isomerism

The origin and consequences of Chirality. R/S designations, "circus dynamics" with models and projection formulas.

Enantiomerism, resolution of enantiomers. Meso compounds. Fischer P.F.

Specific rotation, Enantiomeric excess and optical purity.

Stereochemistry in small – medium rings.

Module 7

Organohalogen Compounds – the relative wealth of haloalkane chemistry

A Detailed examination of S_N reactions: kinetics, stereochemistry, stereoelectronic requirements in S_N2, reaction profiles, factors affecting the partitioning of a reaction among the pathways.

A Detailed examination of E reactions: kinetics, stereochemistry, stereoelectronic requirements in E2, reaction profiles, factors affecting the partitioning of a reaction among the pathways, the Hammond-Leffler postulate and Zaitsev's rule, exceptions to Zaitsev's rule.

Module 8

Physical properties alkenes and alkynes. Nomenclature:E/Z terminology, terminal and internal alkenes, dienes, polyenes, isolated, conjugated, cummulated.

Preparations of alkenes: dehydrohalogenation, dehalogenation, dehydration, syn and anti hydrogenation of alkynes.

Preparations of alkynes: dehydrohalogenation, dehalogenation, from lower alkynes

Reactions of alkenes/alkynes: hydrogenation, hydrohalogenation, halogenation, hydration, oxidation (including oxidative cleavage and hydroxylation). Markovnikov/anti-Markovnikov additions and their chemical rationales in terms of electronic/steric/orbital effects.

Examinations and Grading:

There will be five exams (two multiple choice and three discussion-type) during the course of the semester (dates are given above); the lowest grade on those exams will be dropped. Each of the remaining four exams will be worth 20% of your grade (**total = 80%**) and the final (multiple choice) will be worth 20%**. The final will be a standard American Chemical Society (ACS) Organic Chemistry exam.** There will be no make-up exams; if you miss an exam, it will count as the one you drop. **Don't miss more than one.**

Supplementary material:

The textbook (by Solomons) as well as the text by Weeks on "Pushing electrons" are highly recommended. A molecular models kit (available in the bookstore) is also a very good idea to buy either individually or as part of a group. There is an abundance of my past exams/keys as well as worksheets on Blackboard. Use them as you study and prepare for exams. Although the same questions most likely will not appear on your exams, the reserve material gives a good indication of the types of questions that will feature on exams and, more importantly, of the depth of the responses I require.